Dr. Reichler's Bio 325 class time:_____ Print Name:_____KEY_____
Exam #3 December 5, 2007

Read each question carefully and don't hesitate to ask if a question seems unclear. If possible, answer each question in the space provided, but if needed, continue on the back. If you use a drawing as part of your answer, be sure to also include a written explanation. **For any inheritance problem, you must show your work to receive partial credit.** These questions have specific answers, although for some, more than one answer is possible. To receive full credit you must clearly and fully answer the question being asked. The points for each question are noted in parentheses totaling 103 points.

1. You are studying three genes located on the same chromosome that occur in this order: A, B, and C. Out of 100 offspring there are 30 recombinants of A-B and 40 recombinants of B-C. How many recombinant offspring would you expect between A and C? (Show your work to receive partial credit.) (6 pts)
A and C are not linked, there are 70 m.u. between them and so you would get about 50 recombinants.

2. The telomere length you began life with was based on the length of telomeres in your parents' gametes. If someone inherited short telomeres from one of their parents, would the inheritance of short telomeres be inherited as a dominant or recessive allele? Why? (6 pts)
Dominant. Cells will enter apoptosis or stop dividing when the telomeres get short. So short telomeres on one chromosome will cause the cell to stop dividing/apoptosis.

3. Brittany has inherited a non-functional p53 gene from one parent and a functional p53 from the other parent. Tiffany inherited overabundant telomerase from one parent and normal telomerase from the other parent. Who is more likely to get cancer and why? (8 pts)
Tiffany. One copy of overabundant telomerase will keep the telomeres long keeping the cell from stopping cell division. One functional copy of p53 will be enough to induce apoptosis if the cell has damaged DNA. So Brittany is ok with her one copy of p53, but Tiffany is in trouble with one copy of overabundant telomerase.

4. How could the sister chromatids that line up in the second division of meiosis be identical? (6 pts)
If no crossing over took place.

5. What data would eliminate both the "multiregional" and "out of Africa" hypotheses? (6 pts)
If our common ancestor was found to be more than 1-2 million years ago. OR If our common ancestor was found to be less than 100,000 years ago. OR Fossil evidence indicated that the origin of H. erectus was not in Africa.

6. If the mitochondrial DNA from the blood found on someone's shirt matches the mitochondrial DNA of the victim of a murder, does this evidence demonstrate guilt of the person with blood on their shirt? Why or why not? (8 pts)
No. Millions of people share the same mtDNA sequence.

7. The ends of a gamete's DNA are elongated. What would the ends of a gamete's DNA look like if the gamete lacks primase? Explain. (8 pts)
The 3' end will be elongated by telomerase, but it will be single stranded because the other strand is filled in by the normal replication machinery. Without primase DNA polymerase cannot function.

8. What would happen to *E. coli* that methylated their DNA at the same time as they replicated it? Why? (6 pts)
They would have many mutations. Without a delay in DNA methylation after replication there is no way for the mismatch repair mechanism to know which strand was the original, correct, strand.

9. Would DNA polymerase be able to copy this DNA? 3'-ACGTCGTATGGCTAT-5'
Why or why not? (6 pts) 5'-CCGATA-3'
No. This meets the double strand with a single strand situation that DNA polymerase requires to begin copying, but DNA polymerase cannot add nucleotides to the 5' end.

10. How many DNA ligase proteins would interact with **one** Okazaki fragment on the lagging strand (not at an end of the DNA) during DNA replication? Explain. (6 pts)
2, one where the initial primer was and one where the preceding primer was.

11. You are using a microarray to look at differences in gene expression between cancer and non-cancer cells. To the same chip you add twice as much cDNA from the cancer cells as from the non-cancer cells. Will this affect your results? Why or why not? (6 pts)
Yes. All of the results from the cancer cells will be twice what they normally would be.

12. A woman with excellent ATP production, mates with a male with poor ATP production. They have 12 children, and all of their children have excellent ATP production. Give **two** possible genetic explanations for this result. (Show your work to receive partial credit.) (8 pts)
Inheritance by mtDNA or as a dominant allele with the woman being homozygous dominant and the male being homozygous recessive.

13. Gremlin sex determination works just like in humans. And a gene regulating food preference is on the X chromosome. There are two alleles "likes cinnamon" and "likes mint" that are co-dominant. Would you ever find a male gremlin that liked both mint and cinnamon? Why or why not? (Show your work to receive partial credit.) (8 pts)
No. Males are haploid for genes on the X chromosome, so a male can have one allele but not both.

14. John and Jane are gremlins with the following genotypes and/or phenotypes for wrinkly ears (W= wrinkly ears, dom.; w= non-wrinkly ears, rec.) and ability to be invisible (I= not able to be invisible, dom.; i= able to be invisible, rec.): John is heterozygous for both traits. Joan is heterozygous for wrinkly ears and can be invisible. A successful gremlin needs wrinkly ears and the ability to be invisible. If these genes are on separate chromosomes, what is the chance that John and Joan will have an offspring with these phenotypes? (Show your work to receive partial credit.) (6 pts)
6/16 or 37.5%

15. Eye color in gremlins is coded for by a single gene. Explain how gremlin eye color inheritance works if two gremlins with purple eyes have 100 offspring, with 50 of them having purple eyes. Give the genotypes of the parents and explain why 50 of their offspring have purple eye color. (Show your work to receive partial credit.) (6 pts)
Incomplete or codominance. Both parents are heterozygous and so 50% of offspring will be heterozygous as well.

Bonus: Give an explanation for a tumor that by microarray does **not** show increased MDR (Multiple Drug Resistance) expression, but is still resistant to chemotherapy drugs. (3 pts)
Microarrays do not indicate protein levels. So even though mRNA levels have not changed, the protein level is elevated.

*If you want your grades posted on the class webpage you must provide a codename (it cannot be your EID, SSN, name, or anything that can easily identify you) and give your permission by signing below.

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Codename:_____